

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) A printed circuit board arrangement comprising:
a core substrate having a cavity, and
a resin insulating layer and a conductor circuit laminated on the core substrate,
an IC chip mounted on an outer layer of the conductor circuit, wherein a cavity is
~~formed in the core substrate, and~~
a plurality of capacitors ~~are~~ accommodated in the cavity, the capacitors being located
immediately below the IC chip.
2. (Original) A printed circuit board according to claim 1, wherein a resin is charged
between the plurality of capacitors in the cavity, and the resin has a thermal expansion
coefficient smaller than a thermal expansion coefficient of the core substrate.
3. (Currently Amended) A printed circuit board according to claim 1 or 2, wherein
~~penetrating openings are formed in the resin layer to form~~ has through holes.
4. (Original) A printed circuit board according to claim 1 or 2, wherein a metal film
is formed on electrodes of the capacitor, and an electric connection for the electrodes formed
with the metal film is established by plating.

5. (Original) A printed circuit board according to claim 4, wherein the metal film formed on the electrodes of the chip capacitor is a plated film including copper as a main component.

6. (Currently Amended) A printed circuit board ~~according to claim 1 or 2~~
arrangement comprising:
a core substrate having a cavity therein, and
a resin insulating layer and a conductor circuit laminated on the core substrate, and
a plurality of capacitors accommodated in the cavity, wherein at least a part of electrodes of each capacitor is uncoated with a coating layer and exposed to the outside, and an electric connection for the electrode exposed from the coating layer is established by plating.

7. (Original) A printed circuit board according to any one of claims 1 to 6, wherein a chip capacitor in which electrodes are formed along an inside of the outer edge thereof is used.

8. (Withdrawn from Consideration) A printed circuit board according to any one of claims 1 to 8, wherein a chip capacitor in which electrodes are formed in matrix is used.

9. (Withdrawn from Consideration) A printed circuit board according to any one of claims 1 to 8, wherein a capacitor is mounted on the surface of the printed circuit board.

10. (Withdrawn from Consideration) A method for manufacturing a printed circuit board, comprising at least the following steps (a) to (c) :

- (a) forming a cavity in a core substrate;
- (b) mounting a plurality of capacitors in the cavity; and
- (c) charging a resin between the capacitors.

11. (Previously Amended and withdrawn from consideration) A method for manufacturing a printed circuit board according to claim 10, comprising, after the step (b), a step of applying a pressure to the upper surfaces of the plurality of capacitors in the cavity to align the upper surfaces of the capacitors to the same heights with each other.

12. (Previously Amended and withdrawn from consideration) A method for manufacturing a printed circuit board according to claim 10, comprising, after the step (c), -a step of forming penetrating openings in the resin layer to form through holes.

13. (Withdrawn from Consideration) A method for manufacturing a printed circuit board comprising at least the following steps (a) to (c):

- (a) forming penetrating openings in a resin material having a core material impregnated with a resin;
- (b) attaching a resin material to the resin material formed with the penetrating openings to form a core substrate having a cavity;
- (c) mounting a plurality of capacitors in the cavity of the core substrate; and
- (d) charging a resin between the capacitors.

14. (Withdrawn from Consideration) A method for manufacturing a printed circuit board according to claim 13, comprising, after the step (c), a step of applying a pressure to

the upper surfaces of the plurality of capacitors in the cavity to align the upper surfaces of the capacitors to the same heights with each other.

15. (Withdrawn from Consideration) A method for manufacturing a printed circuit board according to claim 13, comprising, after the step (d), a step of forming penetrating openings in the resin layer to form through holes.

16. (Withdrawn from Consideration) A printed circuit board comprising a core substrate, and a resin insulating layer and a conductor circuit laminated on the core substrate, wherein the core substrate incorporates a connection layer formed by an insulating resin layer including at least one or more layer, and an accommodation layer accommodating a capacitor in its spot-faced section.

17. (Withdrawn from Consideration) A printed circuit board according to claim 16, wherein the accommodation layer incorporates a resin substrate having a core material impregnated with a resin, and the connection layer incorporates a resin substrate having no core material.

18. (Withdrawn from Consideration) A printed circuit board according to claim 16 or 17, wherein the connection layer and the capacitor is connected to each other through a conductive adhesive.

19. (Withdrawn from Consideration) A printed circuit board according to claim 18, wherein the core substrate has a circuit connected to the conductive adhesive between the connection layer and the accommodation layer.

20. (Withdrawn from Consideration) A printed circuit board according to claim 17, wherein the IC chip provided on the surface of the printed circuit board is connected to the terminal of the capacitor through the via holes formed in the connection layer, and

wherein the external substrate provided to the back surface of the printed circuit board is connected to the terminal of the capacitor through the via holes and the through holes formed in the core substrate.

21. (Withdrawn from Consideration) A printed circuit board according to any one of claims 16 to 20, wherein a plurality of the capacitors are accommodated, and a wiring for connecting the IC chip to the external substrate is provided between the capacitors.

22. (Withdrawn from Consideration) A printed circuit board according to any one of claims 16 to 21, a chip capacitor in which electrodes are formed along an inside of the outer edge thereof is used.

23. (Withdrawn from Consideration) A printed circuit board according to any one of claims 16 to 22, wherein a chip capacitor in which electrodes are formed in matrix is used.

24. (Withdrawn from Consideration) A printed circuit board according to any one of claims 16 to 23, wherein a capacitor is mounted on the surface of the printed circuit board.

25. (Withdrawn from Consideration) A printed circuit board according to 24, wherein the chip capacitor mounted on the surface of the printed circuit board has an

electrostatic capacity same or larger than the electrostatic capacity of the chip capacitor incorporated in the printed circuit board.

26. (Withdrawn from Consideration) A printed circuit board according to claim 24, wherein the chip capacitor mounted on the surface of the printed circuit board has an inductance same or larger than the inductance of the chip capacitor incorporated in the printed circuit board.

27. (Withdrawn from Consideration) A printed circuit board according to any one of claims 16 to 25, wherein a metal film is formed on electrodes of the chip capacitor is a plated film including copper as a main component.

28. (Withdrawn from Consideration) A printed circuit board according to any one of claims 16 to 26, wherein a resin having a thermal expansion coefficient smaller than the thermal expansion coefficient of the core substrate is charged between the spot-faced section of the core substrate and the chip capacitor.

29. (Withdrawn from Consideration) A method for manufacturing a printed circuit board, comprising at least the following steps (a) to (c):

(a) forming a circuit pattern on a resin plate on its one side or both sides, and connecting a capacitor to the circuit pattern through an adhesive material;

(b) attaching a resin substrate formed with a cavity for accommodating the capacitor to the resin plate to form a core substrate; and

(c) forming openings extending to electrodes of the capacitor in the resin plate to form via holes.

30. (Withdrawn from Consideration) A method for manufacturing a printed circuit board according to claim 29, wherein, in the attachment step of (c), a pressure is applied to the substrate from its both surfaces.

31. (Withdrawn from Consideration) A method for manufacturing a printed circuit board according to claim 29 or 30, comprising, before or after the step of (c) , a step of forming penetrating openings in the core substrate constituted by attaching the resin plate to the resin substrate to form through holes.

32. (Withdrawn from Consideration) A printed circuit board comprising a core substrate, and a resin insulating layer and a conductor circuit laminated to the core substrate, wherein the core substrate incorporates a connection layer formed by an insulating resin layer including at least one or more layer, and an accommodation layer formed by a resin layer accommodating a capacitor and including two or more layers.

33. (Withdrawn from Consideration) A printed circuit board comprising a resin insulating layer and a conductor circuit laminated to the core substrate,

wherein the core substrate incorporates a connection layer formed by an insulating resin layer including at least one or more layer, and an accommodation layer formed by a resin layer accommodating a capacitor and including two or more layers, and vias for establishing a connection with the capacitor are formed on both sides of the core substrate.

34. (Withdrawn from Consideration) A printed circuit board according to claim 33, wherein the via holes formed in the core substrate are made of a metal film formed by one of methods selected from plating, sputtering, and deposition.

35. (Withdrawn from Consideration) A printed circuit board according to any one of claims 32 to 34, wherein the accommodation layer and the capacitor is bonded to each other by an insulating adhesive.

36. (Withdrawn from Consideration) A printed circuit board according to any one of claims 32 to 35, wherein a plurality of the capacitors are accommodated, and a wiring for connecting an IC chip and an external substrate to each other is provided between the capacitors.

37. (Withdrawn from Consideration) A printed circuit board according to any one of claims 32 to 36, a chip capacitor in which electrodes are formed along an inside of the outer edge thereof is used.

38. (Withdrawn from Consideration) A printed circuit board according to any one of claims 32 to 37, wherein a chip capacitor in which electrodes are formed in matrix is used.

39. (Withdrawn from Consideration) A printed circuit board according to any one of claims 32 to 38, wherein a capacitor is mounted on the surface of the printed circuit board.

40. (Withdrawn from Consideration) A printed circuit board according to 39, wherein the chip capacitor mounted on the surface of the printed circuit board has an electrostatic capacity same or larger than the electrostatic capacity of the chip capacitor incorporated in the printed circuit board.

41. (Withdrawn from Consideration) A printed circuit board according to claim 39, wherein the chip capacitor mounted on the surface of the printed circuit board has an inductance same or larger than the inductance of the hip capacitor incorporated in the printed circuit board.

42. (Withdrawn from Consideration) A printed circuit board according to any one of claims 32 to 41, wherein a metal film is formed on electrodes of the chip capacitor, and an electric connection to the electrodes formed wit the metal film is established by plating.

43. (Withdrawn from Consideration) A printed circuit board according to any one of claim 42, wherein a metal film formed on electrodes of the chip capacitor is a plated film including copper as a main component.

44. (Withdrawn from Consideration) A printed circuit board according to any one of claims 32 to 41, wherein at least a part of electrodes of each capacitor is uncoated with a coating layer and exposed to the outside, and an electric connection for the electrode exposed from the coating layer is established by plating.

45. (Withdrawn from Consideration) A printed circuit board according to claim 35, wherein the insulating adhesive has a thermal expansion coefficient smaller than the thermal expansion coefficient of the accommodation layer.

46. (Withdrawn from Consideration) A method for manufacturing a printed circuit board comprising at least the following steps (a) to (e):

(a) forming penetrating openings for accommodating a capacitor in a first resin material having a core material impregnated with a resin;

(b) attaching a second resin material to the first resin material formed with the penetrating openings to form an accommodation layer having a section for accommodating a capacitor;

(c) accommodating the capacitor in the accommodation layer;

(d) attaching a third insulating resin layer to the accommodation layer formed in the step (c) to form a core substrate; and

(e) forming openings extending to electrodes of the capacitor in the third insulating resin layer to form via holes.

47. (Withdrawn from Consideration) A method for manufacturing a printed circuit board comprising at least the followings steps (a) to (e):

(a) forming penetrating openings for accommodating a capacitor in a first resin material having a core material impregnated with a resin;

(b) providing a capacitor to the second resin material at a position corresponding to a section for accommodating a capacitor in the resin material;

(c) attaching the first resin material subjected to the step (a) and the second resin material subjected to the step (b) to each other to form a accommodation layer accommodating the capacitor;

(d) attaching a third insulating resin layer to the accommodation layer to form a core substrate; and

(e) forming openings in the third insulating resin layer extending to electrodes of the capacitor to form via holes.

48. (Withdrawn from Consideration) A method for manufacturing a printed circuit board comprising at least the following steps (a) to (f):

(a) forming penetrating openings for accommodating a capacitor in a first resin material having a core material impregnated with a resin;

(b) providing a capacitor to the second resin material at a position corresponding to a section for accommodating a capacitor in the resin material;

(c) attaching the first resin material subjected to the step (a) and the second resin material subjected to the step (b) to each other to form an accommodation layer accommodating the capacitor;

(d) attaching a third insulating resin layer to the accommodation layer to form a core substrate;

(e) forming openings in the third insulating resin layer extending to electrodes of the capacitor to form via holes; and

(f) forming a conductive film in the penetrating openings of the first resin material and the openings of the third resin material to form via holes.

49. (Withdrawn from Consideration) A method for manufacturing a printed circuit board according to any one of claims 46 to 48, wherein, in the attachment step of (d), a pressure is applied to the substrate from its both surfaces.

50. (Withdrawn from Consideration) A printed circuit board comprising a core substrate, and a resin insulating layer and a conductor circuit laminated to the core substrate,

wherein the core substrate incorporates an accommodating layer having penetrating openings in each of which a capacitor is accommodated, and connection layers each made of an insulating resin layer and provided on the front surface and the back surface of the accommodation layer.

51. (Withdrawn from Consideration) A printed circuit board according to claim 50, wherein the accommodation layer incorporates a resin substrate having a core material impregnated with a resin, and the connection layer incorporates a resin substrate having no core material.

52. (Withdrawn from Consideration) A printed circuit board according to claim 50 or 51, wherein the capacitor is fixed in each of the penetrating openings of the accommodation layer through an insulating adhesive.

53. (Withdrawn from Consideration) A printed circuit board according to any one of claim 50 to 52, wherein the connection layers provided on the front surface and the back surface of the accommodation layer are provided with via holes for connecting the connection layers to an IC chip and an external substrate.

54. (Withdrawn from Consideration) A printed circuit board according to any one of claims 50 to 53, wherein a plurality of the capacitors are accommodated, and a wiring for connecting the IC chip to the external substrate is provided between the capacitors.

55. (Withdrawn from Consideration) A printed circuit board according to any one of claims 50 to 54, wherein a capacitor is mounted on the surface of the printed circuit board.

56. (Withdrawn from Consideration) A printed circuit board according to 55, wherein the chip capacitor mounted on the surface of the printed circuit board has an electrostatic capacity same or larger than the electrostatic capacity of the chip capacitor incorporated in the printed circuit board.

57. (Withdrawn from Consideration) A printed circuit board according to claim 55, wherein the chip capacitor mounted on the surface of the printed circuit board has an inductance same or larger than the inductance of the chip capacitor incorporated in the printed circuit board.

58. (Withdrawn from Consideration) A printed circuit board according to any one of claims 50 to 55, wherein a chip capacitor in which electrodes are formed along an inside of the outer edge thereof is used.

59. (Withdrawn from Consideration) A printed circuit board according to any one of claims 50 to 55, wherein a chip capacitor in which electrodes are formed in matrix is used.

60. (Withdrawn from Consideration) A printed circuit board according to any one of claims 50 to 59, wherein a metal film is formed on electrodes of the capacitor, and an electric connection for the electrode formed with the metal film is established by plating.

61. (Withdrawn from Consideration) A printed circuit board according to claim 60, wherein the metal film formed on electrodes of the chip capacitor is a plated film including copper as a main component.

62. (Withdrawn from Consideration) A printed circuit board according to any one of claims 50 to 58, wherein at least a part of electrodes of each capacitor is uncoated with a coating layer and exposed to the outside, and an electric connection for the electrode exposed from the coating layer is established by plating.

63. (Withdrawn from Consideration) A printed circuit board according to claim 52, wherein the insulating adhesive has a thermal expansion coefficient smaller than the thermal expansion coefficient of the accommodation layer.

64. (Withdrawn from Consideration) A method for manufacturing a printed circuit board comprising at least the following steps (a) to (d):

(a) forming penetrating openings for accommodating a capacitor in a first resin material having a core material impregnated with a resin;

(b) accommodating a capacitor in each of the penetrating openings of the first resin material;

(c) attaching a second resin material to the first resin material to form a core substrate; and

(d) forming openings extending to electrodes of the capacitor in the second resin material of the core substrate to form via holes.

65. (Withdrawn from Consideration) A method for manufacturing a printed circuit board according to claim 64, comprising, before or after the step (d), a step of forming penetrating openings on the core substrate to form through holes.

66. (Withdrawn from Consideration) A method for manufacturing a printed circuit board according to claim 64 or 53, wherein, in the attachment step (c), a pressure is applied to the substrate from its both surfaces.

67. (Withdrawn from Consideration) A printed circuit board comprising a core substrate, and a resin insulating layer and a conductor circuit laminated to the core substrate, wherein a capacitor is accommodated in the core substrate.

68. (Withdrawn from Consideration) A printed circuit board comprising a core substrate, and a resin insulating layer and a conductor circuit laminated to the core substrate, wherein the chip capacitor is accommodated in the printed circuit board in the state where at least a part of electrodes of each capacitor is uncoated with a coating layer and exposed to the outside, and an electric connection for the electrode exposed from the coating layer is established by plating.

69. (Withdrawn from Consideration) A printed circuit board according to claim 68, wherein the metal film formed on electrodes of the chip capacitor is a plated film including copper as a main component.

70. (Withdrawn from Consideration) A printed circuit board comprising a core substrate, and a resin insulating layer and a conductor circuit laminated to the core substrate, wherein the chip capacitor is accommodated in the state where a metal film is formed on electrodes of the capacitor, and an electric connection for the electrodes formed with the metal film is established by plating.

71. (Withdrawn from Consideration) A printed circuit board according to claim 70, wherein the metal film formed on electrodes of the chip capacitor is a plated film including copper as a main component.

72. (Withdrawn from Consideration) A printed circuit board according to any one of claims 67 to 70, wherein a chip capacitor in which electrodes are formed along an inside of the outer edge thereof is used.

73. (Withdrawn from Consideration) A printed circuit board according to any one of claims 67 to 72, wherein a chip capacitor in which electrodes are formed in matrix is used.

74. (Withdrawn from Consideration) A printed circuit board according to any one of claims 67 to 73, wherein a plurality of chip capacitors from each of which a plurality of pieces are to be obtained are coupled into one-piece unit, and the one-piece unit is used.

75. (Withdrawn from Consideration) A printed circuit board comprising a core substrate, and a resin insulating layer and a conductor circuit laminated to the core substrate, wherein a capacitor is accommodated in the core substrate, and a capacitor is mounted on the surface of the printed circuit board.

76. (Withdrawn from Consideration) A printed circuit board according to 75, wherein the chip capacitor mounted on the surface of the printed circuit board has an electrostatic capacity same or larger than the electrostatic capacity of the chip capacitor in the core substrate.

77. (Withdrawn from Consideration) A printed circuit board according to claim 75, wherein the chip capacitor mounted on the surface of the printed circuit board has an inductance same or larger than the inductance of the chip capacitor incorporated in the printed circuit board.

78. (Withdrawn from Consideration) A capacitor to be incorporated in a printed circuit board, wherein a copper plated film is coated on the surface of a metallized electrodes of a chip capacitor.

REMARKS

Claims 1-78 are presently pending in the application, with claims 7-78 being withdrawn from consideration. Claims 1, 3 and 6 are currently amended.

Applicant appreciates the Examiner's indication of allowable subject matter in claim 6m, which has been rewritten into independent form as suggested by the Examiner.

Claims 1-3 are rejected under 35 U.S.C. 102(b) as being anticipated by Gorczyca et al. (U.S. Patent 5,161,093, hereafter Don). Claims 4-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gorczyca et al. ('093) in view of Sunahara (U.S. Patent 6,153,290). These grounds of rejection are respectfully traversed.

In our claimed inventions, the structural arrangement accommodates a plurality of capacitors. As mentioned in page 77 line 15 to page 78, line 33, "The effect of providing the chip capacitors 20 and 120 will be described with reference to Fig. 22." In our graph shown in Fig. 22, the longitudinal axis indicates a voltage supplied to the IC chip, and the horizontal axis indicates a time. The chain double-dashed line C indicates the variation in the voltage supplied to the printed circuit board having no capacitor for power source. Without a capacitor for power supply, the voltage is drastically attenuated. The broken line A indicates the variation in the voltage supplied to the printed circuit board having a chip capacitor on its surface. As compared with the case of the printed circuit board having no capacitor indicated by the chain double-dashed line C, the attenuation of voltage is not large. However, the length of loop becomes large, and sufficient electric power cannot be supplied in the rate determining step. That is, the voltage drastically drops down at the time of starting the supply of electric power. The chain double-dashed line B, referring to Fig. 8, indicates the voltage drop of the printed circuit board incorporating the chip capacitor. Whereas the length of the loop can be shortened, the voltage varies because a chip capacitor having a large capacitor cannot be accommodated on the core substrate 30.

In the case of eight capacitors connected in parallel:

Capacitors of embedded type: 60pH

Capacitors of back surface mounted type: 72pH

In both cases where a single capacitor is used and where a plurality of capacitors are connected in parallel to obtain an increased capacity, an inductance can be lowered by incorporating the chip capacitor.

Also, in our claimed inventions, “the capacitors are located immediately below the IC chip.” As mentioned on page 83, lines 2 to 7, “the chip capacitors 220 are placed immediately below the IC chip 290. The distance from the IC chip to each capacitor is shortened, and therefore, electric power can be instantaneously supplied to the IC chip. That is, the loop length which determines the loop inductance can be shortened.”

The Gorczyca reference suggest a high density interconnect structure 10 of which the substrate 12 has cavities 14 wherein ICs 16 are disposed. Gorczyca does not suggest “an IC chip mounted on the outer layer thereof” and “the capacitors are located immediately below the IC chip.”

The Sunahara reference shows the ceramic substrate including a plurality of capacitors, however Sunahara Patent does not show nor suggest the circuit board of mounting an IC chip. As shown in Fig. 3, the sheet-like support 48, 49 formed of ceramics are mounted on external terminal conductors (outmost layer) 19a, 19b. Sunahara Patent does not mount the IC chip.


Reconsideration of this application based on the above amendments and remarks is respectfully requested. If the Examiner has any questions or concerns about the present

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Amendment or this application, the Examiner is respectfully requested to contact the undersigned at the telephone number listed.

Respectfully Submitted,

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